IWT-Observatory

Institute for the Promotion of Innovation
by Science and Technology in Flanders

Innovation Science Technology

41

Spinning off new ventures: a typology of facilitating services

BART CLARYSSE
ANDY LOCKETT
THELMA QUINCE
ELS VAN DE VELDE

COLOFON

IWT-Studies is published by IWT-Vlaanderen as part of the work programme of the IWT-Observatory. However, the authors are personally responsible for the standpoints adopted in the development of these studies.

Editors
Ann Van den Bremt (secretariat)
Jan Larosse (co-ordination)

Production
N'lil

Copyright
Reproduction and use is permitted subject to acknowledgement of source

IWT-Observatory
Jan Larosse, Co-ordinator
Donald Carchon, Information system
Ann Van den Bremt, Secretariat
Henri Delanghe, Policy analysis

Bischoffsheimlaan 25
1000 Brussels

Phone: 02/209 09 00
Fax: 02/223 11 81
E-mail: iwt-observatorium@iwt.be
Web-site: http://www.iwt.be
Registration number: D/2002/7037/6
Published in December 2002

CONTENTS

SUMMARY

This study analyses the spin-out activity in seven technology transfer units, which are considered to be successes in Europe: Crealys in France, the Top Initiative of the university of Twente in the Netherlands, Leuven R&D at the KUL in Belgium, Business Development at IMEC in Belgium, BioM in Germany (Munich area), Technology Transfer Partners (TTP) and Scientific Generics, both in Cambridge, UK. In each of these institutes, an in depth analysis is made of how they organise the following activities: (1) sensibilisation and Detection of opportunities, (2) management of IPR, (3) selection of spin-out projects, (4) incubation and business plan preparation, (5) financing of these spin-outs and finally (6) the follow-up of spin-outs after start-up.

Based upon the analysis of these activities, three different models have been defined: a *self selective* model, a *supportive* model and a *protective* model. In the first model, the specific aim is to generate as many start-ups as possible. Stimulating general entrepreneurship rather than financially or economically attractive companies are thus the goal. This means that sensibilisation and opportunity seeking is the main activity. In the second model, the emphasis lies on creating economically attractive companies with a transitional starter profile. These companies might not yet have a financially attractive business plan but have the ambition to make one in the future. Usually they are based upon the IP generated in the mother institute. Management of IPR and business plan preparation are crucial activities in this model. Finally, the protective model focuses on the creation of financially attractive companies, which receive VC-money at start. In addition to the previous activities, also financing activities are of crucial importance here.

In addition to analysing the activities developed in each of these models, also the resources necessary to organise these activities are examined. In the first model, the crucial resources seem to be an experienced entrepreneur as manager who can sensibilise students, researchers and professors to start up a company and public money to facilitate this start up. In the second model, a financially autonomous organisation is needed which is strongly supported by the top management of the university in its activities. This organisation needs to have a minimum critical mass of people specialised in legal issues, IPR and business plan development. In addition, a public-private early stage.
Capital fund is needed to support the start-ups. Finally, the protective organisation needs a worldwide recognised leading research team in a particular technology. The tech transfer or business development unit needs to be able to incubate the organisation and facilitate the recruitment of external management, attraction of international early stage venture capital and the formation of the company's intellectual property base.

FOREWORD

The number of research-based spin-offs has increased sharply in Flanders since the second half of the nineties. A preceding IWT-Study* recorded more than 100 in total. Although this number of firm creation and the employment in these companies seem to have only a limited impact on the Flemish economy, this spin-off phenomenon is of great importance for the development of the Flemish innovation system and for economic renewal of the Flemish economy in a longer-term perspective. Spin-off activities are indeed a good indicator for the intensification of science-industry relations in the Flemish innovation system and carry a promise for new growth opportunities.

The success of this complex process of spin-off creation is dependent on multitude of conditions, ranging from a further market-oriented development of the innovative technology, of course, to a whole set of complementary conditions that are necessary to create a business venture. To facilitate this process all Flemish universities have established 'interface services'. These services are building up quickly experience on different levels of commercialisation of research results. They play a central role in the creation of a conducive environment of spin-off creation at the universities. The Flemish government supports the activities of interface services already many years. With its Decision of 13 September 2002 it provides a framework for a structural support to the interface services that allows them to develop their activities in a long-term perspective.

IWT has been allocated a role of coordination of all innovation intermediaries in the 1999 Innovation Decree. Part of this mission is also a platform for the exchange of experiences among the interface services. In support in this exchange of experiences the IWT-Observatory has been involved in benchmarking activities. One of the inputs in this 'learning' process is international benchmarking. IWT has participated in the European STRATA network on 'The Role of Technology Policy in Incubating European New Technology Based Firm's' (INCUPUB), together with the Vlerick School of Management. Some of the results of international bench-marking on the support to spin-off creation by facilitating services has been analysed and synthesised in a recent report to the European Commission under the redaction of Professor Bart Clarysse, also associated with the IWT Observatory. It is this report that is presented now in the IWT-Studies series. The Study contributes to policy thinking and policy development.

Although the results have to be interpreted as a 'snapshot' in the quickly evolving landscape of 'spin-out models', the message is clear that the interplay of actors, according to their resources, reacting to changes in the environment, is at the hearth of the design of successful models of spin-off creation. One of the important new elements contributing to the success of spin-off creation in the proceeding period was the emergence of a venture capital sector in Flanders. What will be the effect of the recent crisis in this sector?

IWT has a role of complementing 'risk capital'. Recent research conducted by the Vlerick School of Management has given strong indications on the great significance of this role in the recent past. A survey among 68 research-based start-ups has shown out that nearly 60% obtained investment from venture capitalists (totalising 80 million Euro) and more than 75% subsidies by IWT (totalising 40 million Euro). On average the part of subsidies amounts to nearly 50 % of the capital. With the present crisis of venture capital the role of IWT in remediating market failures might increase. Financing is a key element in the overall picture of success conditions offered by several types of 'facilitating services'.

Paul Zeeuwts
President IWT

Chapter 1

INTRODUCTION

Spinning off new ventures from research institutions has played a key role in the development of high-technology clusters such as Boston and Silicon Valley (e.g., Roberts 1991; Saxenian 1994). Also in Europe, the phenomenon of spin-out — companies created to commercialise technologies developed in research institutions — is not new. Some well-known large firms were started by scientists in the 19th century or the early part of the 20th century. Werner von Siemens and Gerard Philips set up spin-offs, which would later develop into well-known multinationals (Mustar 1995). However, these spin-outs did not result from any structural process of research commercialisation. Often, these companies were founded by entrepreneurs despite the research institute with which they were associated. Only recently, research institutes have devised "pro-active " policies to stimulate the commercial exploitation of public research, through spin out formation (e.g. Callan 2001; European Commission 1998). In parallel, there have been changes in the institutional environment to make such a policy possible: laws have been changed to assign ownership of intellectual property to research organizations. Employment laws have been loosened to allow public sector researchers more contact with the private sector and various initiatives introduced to provide early stage start-up capital.

Despite these changes, detailed knowledge of the processes of proactively spinning out new ventures from research institutions remains scarce, especially in an environment where high tech entrepreneurship is a relatively new phenomenon. Roberts and Malone (1996) stress in a pioneering article that the process of spinning-out ventures from research institutions is very different in those contexts compared to the entrepreneurial environment of Boston or Silicon Valley. In developed contexts, such as the latter two examples, there is already a strong entrepreneurial community with the capability to select the best projects and allocate resources to them. So, the spin-off process can follow a "business pull" process, which is not dependent alone on the activities of research institutions. In contrast, in contexts, where no strong entrepreneurial community is present, research institutions need to be more proactive and supportive of spin-off projects. Here the process is more "technology push" in which research institutions exercise selection and provide support. In a recent study about spin-outs in Belgium, Degroof (forthcoming) distinguished six activities, which can be organized by these research institutions or universities to provide spin-out support: (a) Technology opportunity search; (b) Intellectual property assessment and protection; (c) Selection of spin-off project; (d) Incubation or business plan development; (e) Support with start-up process and (f) Funding process.

This paper analyses (a) the extent to which parent organizations differ in how they organize and manage the activities involved in the spin-out process; (b) what resources are needed to successfully undertake spin out process and (c) whether differences in the organization and management of the spin out lead to more spin-outs of a certain type. These research questions are addressed in the following way. In line with Eisenhardt's (1989) view on building theory from case study research, European cases, with a proven and widely recognized track record in spinning out new ventures were selected. Based upon these cases, three different models of spin-out activity were distinguished: a protective model, a supportive model and a low selective model. We analyse these three models in the light of the research questions outlined above. In addition, using the resource-based theory of the firm as a theoretical framework (Barney, Wright and Ketchen, 2001), we assess which resources these institutes use to successfully organize their activities.

The paper unfolds along the following lines. First, we discuss the methodology that guided our data collection and analysis. The paper concludes by returning to the question of the context within which these activities are set and draws implications for policy.

Chapter 2

METHODOLOGY

The impetus that triggered this research project originated from observations in the field rather than theory. We therefore found it more appropriate to adopt an inductive design, drawing upon insights from the field with the aim of building hypotheses and possibly theory (Eisenhardt 1989). This approach also seemed justified by the fact that the literature on the technology transfer function in Europe is limited and rather descriptive. In addition, much of the literature on organization theory and entrepreneurship is US-centred. Despite the growing interest in the commercialisation of research by academics as well as policy makers, very little seems to be known about how technology transfer activities, and spinning off processes in particular, are organized in the parent institution.

> RESEARCH DESIGN: MULTIPLE CASES, HIERARCHICAL CASE SELECTION

In order to identify different spin-out activities, we started with an analysis of the regions where the science and technology base was present. Therefore, a European map of scientific regions of excellence was prepared by our research group. Using the number of publications and patents per capita and the total R&D expenditures as a percentage of GDP as indicators of technology poles, following regions were identified (Clarysse, Heirman and Degroof, 2001): Île de France and Rhône-Alpes in France, Flanders and Wallonia in Belgium, Southeast England (London/Cambridge) in the UK, the Netherlands[3], Baden-Württemberg, Bayern and the Heidelberg-Stuttgart-Mannheim triangle (Germany), Northern Italy (Triangle Milan-Bologna-Pisa) and, finally, the capital regions of Sweden and Finland.

In each of these regions a local university researcher was contacted to participate in the study using a network financed by the European Commission as a vehicle. Because of travel and communication difficulties, the Finnish and Swedish research groups contacted did not want to participate. Each of the researchers in the network was asked to identify in his region technology transfer units who are associated with universities or public research institutes that had active spin-out services. This process resulted in a list of 45 services distributed over the different regions.

An exploratory phone interview was undertaken in each of these cases to analyse the extent to which the spin out policy was developed in each of the institutes. Among the 45, 11 spin-out services were selected for further analysis based upon the following criteria: (1) they needed to be founded at least before 1997; (2) they needed to have a documented record of spin-outs; (3) the local researchers had to consider them as "interesting" examples of successful spin-out activity. Their perception was based upon references made in the telephone interviews to these institutes. Seven cases appeared to be interesting: Scientific Generics and TTP in the UK; Leuven R&D and IMEC in Belgium; BioM in Germany; University of Twente in the Netherlands and, finally, Crealys in France. In comparison to the other cases on the list, the spin-out activity in these institutes appeared better developed.

> DATA COLLECTION AND ANALYSIS

Data on each case was collected through a variety of techniques including personal interviews with several persons[4] in the institutes and secondary data sources such as annual reports, web sites and descriptions of the institutes in local press... For each of the institutes, the way they organized the spin-out process was mapped using the different activities of spin-out management defined by Degroof (2002) as a guideline. The first phase of a spin-out process itself, starts with the extent to which the institute engages in a technology opportunity search consisting of trying to identify technologies with a commercial potential. Second, it can be followed by an intellectual property assessment consisting of assessing if patents have been already filed for the specific technology and, if not, perhaps filing one or more patents. This step can involve examining the choice between options of commercialisation, primarily the choice between licensing and commercialising through a spin-off venture. Third, the process involves selection of the spin-off

[3] No data at regional level are available for the Netherlands, Finland and Sweden.

[4] The persons selected to be interviewed were mostly in a management position at the institute.

project based on its intrinsic potential and on the comparison with alternative projects. Fourth, once the project is selected and a team volunteers to carry it out, or is selected to carry it out, a phase of business development plan is necessary. Fifth, once a business plan exists and is accepted, research institutions channel their spin-off process towards some forms of funding process. Sixth, once funding is obtained, the venture can formally be incorporated, at which point the research institution, or another party can provide start-up coaching. Although in practice, the founding of spin-outs is not as linear as presented in this step model, it offers a good comparative framework against which to map the activities by the different institutions. Using a structured questionnaire[5] as a guideline, we assessed to which extent and how each of the interviewed spin-out services organised or was engaged in the particular activity. For instance in the case of technological opportunity search, we examined the degree to which different tasks such as 'informal visits to the research labs', 'organisation of a business plan competition', 'structured brainstorming with research groups', 'mapping of the research activity' were carried out by the spin-out service.

We did not only analyse the activities of spinning out new start-ups, also the resources that were developed to efficiently organize these activities were looked at in depth. The resource-based theory of the firm was used as a theoretical framework to classify these resources: human (individual skills, knowledge), social (external relationships, networks), financial (budget), physical (infrastructure), organizational (routines and procedures developed) and technical (access to science/technology base) were distinguished. Concerning the seven successful cases, we analysed to which extent the resources that were present were crucial to organize the activities described above. The four failed cases were – to the extent possible – used as a benchmark to assess the importance of not having certain resources.

[5] **The questionnaire is available upon request**

Chapter 3

THREE TYPES OF SPIN-OUT SERVICES

Based upon the data collected in each of the eleven cases selected, three different types of spin out models were compiled: (a) the low selectivity model; (b) the supportive model; (c) the protective model.

> 3.1 "LOW SELECTIVITY" MODEL

The TOP initiative in Twente, Crealys and Atelier de l'Innovation in France converge in terms of activities and resources towards a certain model, which we label the **"low selectivity" model**. We discuss below which activities and resources are specific for this model.

CASE 1 > THE TOP CASE (THE UNIVERSITY OF TWENTE)

Resources

A. Organizational resources. TOP is a program that is executed by the Dutch Institute of Knowledge Intensive Entrepreneurship (NIKOS) from the University of Twente since 1984. It is funded with support from the ERF, managed by the European Commission.

B. Human resources. There are many people from the University of Twente involved. The TOP-coordinator and some secretarial support (total 2 fte) and the people (2/TOPPER) from research groups who are hosting the entrepreneur during his TOP-year. There are also two permanent members of the TOP review committee from outside university.

C. Technological resources. TOP supports every start-up company who is active on one of the fields of knowledge of the University of Twente and is able to link up with a research group.

D. Physical resources. The entire university acts as an incubator. The entrepreneur has almost the same access to offices and lab facilities as a researcher has. There is also a special incubator building near the campus where the University of Twente is one of the shareholders. There every tenant has to pay rent.

E. Financial resources. Every TOP entrepreneur receives an interest free personal loan of 12.000 euro during the TOP year. For this purpose a revolving fund of 1.000.000 euro is available.

F. Social resources. The networks from the research group and TOP committee are available for the TOP entrepreneurs

Activities

A. Opportunity seeking. TOP is well known in the University of Twente and in the region. Every research group sends their potential TOP entrepreneur to the TOP coordinator who will guide and prepare the entrepreneur for the selection procedure.

B. IPR assessment and protection. Every TOP entrepreneur makes his own agreements with the research group/faculty on this subject. There is a university attorney to advise the research group and the entrepreneur.

C. Selection of the spin-out process. If the research group is willing to host the entrepreneur, they need to write a business plan. It is also important that they have more than 30 ours per week available for their company. Since 1984 310 entrepreneurs received a TOP position in several research groups.

D. Incubation process. Every research group can act as an incubator.

E. Funding. University is just beginning to invest in TOP companies. Recently in 1 TOP company.

F. Control of the spin-out process. After the TOP-year the TOP company has to leave the University but if they still want to use university facilities they have to pay for that. During the TOP year the TOP committee evaluates the progress.

Activities

A. Opportunity Seeking. In contrast to the two other models discussed below, opportunity seeking remains very passive in the low selectivity model. Crealys and Atelier de l'Innovation limit their opportunity seeking to regular visits by TTO- staff to departments of the universities and public research laboratories. Twente refers to the entrepreneurial mission of its parent university as a main driver of spin-out activity (Karnebeek, 2001).

B. Selection of the Spin-out Project. The selection criteria or entry barriers are quite low and not based upon growth orientation. For example, In the last 2 years, Crealys received 160 projects of which the selection committee approved 60 projects[7]. University of Twente selected in the last two years about 60 projects out of a total of 130 (Karnebeek, 2001). The interview data suggest that in both cases the formal representation of the project play a larger role than the practical test of the assumptions. It is illustrative that Crealys selects projects based upon two criteria: they have to be based upon technical developments and they have to be willing to cooperate with the research institute they spin off from.

C. IPR Assessment and Protection. With regards to the IPR situation, the technology transfer office of the parent research institute or university is likely to patent the basis technology but this is unlikely to be the key trigger to start-up a company. This unimportance of IPR is again very different from the two other models. For example in Twente, only 7% of spin-outs founded after 1980 had a formal IP position (e.g. a patent).

D. Incubation process. In this model, start-ups stay within the parent research organisation.

E. Funding. Public money is crucial to fund these early stage projects. It is illustrative that the Twente entrepreneurs regard the start-up fund they get from the university as a means of sustenance rather than as start-up capital.

F. Control of the spin out process. A wide range of businesses is selected. Among them, as in any start-up population, many will are small, with very low levels of capitalization, more locally or nationally focused. Among all projects started by Crealys in France, only about 10% resulted in a growth oriented venture capital backed company. This percentage is similar as the one we would expect among a natural population of

[7] **Annual Report of 'les incubateurs publiques'.**

CASE 2 > THE BIO^{M} CASE

Resources

A. Organizational resources. Bio^{M} is a private organization that was created by the State of Bavaria, VC companies and the local Pharma and Chemistry industry as a result of the BioRegion Competition in Germany in 1997.

B. Human resources. Bio^{M} employs 13 people: 4 scientists with a Ph.D.; 3 scientist without a Ph.D.; 2 people with a communication background; 3 people with an economic background. The managing director and CEO, Prof.. Dr. Domdey is a professor of Biochemistry and co-founder of 2 spin-out companies called Medigene AG and Swith Biotech Gmbh. The board of directors exists out of professors of nearby located universities and people representing financial institutes.

C. Technological resources. Bio^{M} only supports companies situated in the biotechnology sector and in the life sciences sector. Bio^{M} has well-established contacts with 5 institutes: Max-Planck-Institut für Biochemie,Max-Planck-Institut für Neurobiologie, the Ludwig-Maximilians-Universität, the Technical University of Munich and GSF (Forschungszentrum für Umwelt und Gesundheit)

D. Physical resources. Bio^{M} does not have an own incubation centre, but has developed a close relationship with IZB (the CEO of Bio^{M} is the scientific CEO of IZB). IZB owns 2 incubation centres in the area of Munchen.

E. Financial resources. ioM has already invested approximately 8 million EURO in spin-out companies. Within Germany, a lot of grants exist to support spin-out companies.

F. Social resources. The fact that Bio^{M} is created as an initiative originating from various industrial companies, contributes to the well-developed contacts of Bio^{M} with the industry in the area of Munchen.

start-ups in technology intensive sectors. Atelier de l'Innovation went broke because among its 30 projects in the pipeline, none could establish a real growth orientation.

Resources

A. **Organizational resources.** The spin-out service tends to be a broker or match-maker between the researchers within the university(s), the public sources of finance and the administration. In Twente, Crealys and Atelier de l'Innovation this match making function was of extreme importance.
B. **Human resources.** In line with this match making function, he spin-out unit employs a small team of people who are familiar with the existent programs of the government to receive grants.
C. **Technological resources.** In contrast to the other models, the spin-out services in this model do not have a technological focus.
D. **Physical resources.** Office space and infrastructure are organized within the universities and do not play a determining role.
E. **Financial resources.** In order to organize this kind of activity, the spin out service should have control over public money. Crealys received 1,5 mio Euro (spread over 3 years) of the "Ministère de la recherche" because it was selected as public incubator in the call for projects. Crealys also receives each year 200 000 Euro of the City of Lyon, 1 mio Euro of the region Rhone-Alpes and 500 000 Euro of the associated universities. Twente uses money from the European Social Fund. Atelier de l'Innovation was an entirely privately financed initiative and went broke.
F. **Social resources.** The success of this model seems to be very dependent upon the social network, which the spin-out service has developed with various public agencies and the relation with the research departments or institutes with to which it is attached.

Activities

A. **Opportunity seeking.** If a researcher got a good idea, he first goes to the Technology Transfer office within his own university. The TTO will mostly encourage him to take part to the Business Plan Competition. Within the region, there exist a company called "Business Plan Competition". This is a company whose main (and only) goal it is to organize a BP competition within the Munich area. This company is giving BP advice to all companies in a very early stage. Once a researcher has a good BP (not prerequisite with help of the Business Plan Competition), he can come to Bio^{M} with his BP.
B. **IPR assessment and protection.** Bio^{M} does not offer specific IPR support, but they have established close contacts with patent attorneys.
C. **Selection of the spin-out process.** Since the start, Bio^{M} has received 130 business plans and has invested directly in 28 spin-out companies. Bio^{M} received 12 business plans in 1997, 36 business plans in 1998, 30 business plans in 1999, 22 business plans in 2000 and 30 business plans in 2001. The total number of 130 business plans contains some business plans counted double, due to the fact that some business plans return to Bio^{M} after a major change at the business plan.
D. **Incubation process.** Bio^{M} does not have an own incubation centre, but operates as contact point in the search for housing the spin-out companies. Bio^{M} offers business plan advice, provides contacts to patent attorneys, offers support with grant applications and organizes networking events.
E. **Funding.** Bio^{M} invest a maximum of 250 000 Euro in spin-out companies and takes shares of the companies on average around 7 %.
F. **Control of the spin-out process.** Bio^{M} considers themselves as a private VC company in an early stage, which does not focus on high growth companies. In BioM, 35% of the spin-out companies have already received venture capital financing.

> 3.2 "SUPPORTIVE" MODEL

The Leuven R&D case, the Bio^{M} case and Heidelberg Innovation are three initiatives, which can be seen as **"supportive models"** of spin-out activity.

Activities

A. Opportunity Seeking. Opportunity seeking is organized in the same way as a VC: the spin-out service attracts business plans.

B. Selection of the Spin-out Project. Under this model there are clear selection criteria. For a business plan to be selected, it has to show growth, product-, and international orientation (in the long term). BioM received 130 business plans in the last 5 years. They invested directly in 28 spin-out companies. Leuven R&D aims at starting up 5-7 projects each year and has accepted 18 projects in the last two years (Debackere, 2001). The criteria look like those used by VCs, but the assumptions in the business plan are usually less elaborated.

C. IPR Assessment and Protection. The companies founded in this model are usually single patent companies. It is clear that no technology platform is built through licensing in pieces of technology to complement the existing technology. Nevertheless, Leuven R&D, BioM and Heidelberg consider the availability of a patent as a crucial factor.

D. Incubation process. Under this model more incubation support activities and facilities are provided although they are not necessarily owned by the spin-out service. Usually the spin-out service has some kind of formal collaboration with an incubation centre. For instance, BioM has developed a close relationship with IZB (the CEO of BioM is the scientific CEO of IZB). IZB owns 2 incubation centres in the area of Munchen.

E. Funding. This type of model in general is involved in some kind of public/private partnership fund. For instance, in Leuven R&D the fund is owned 20% by the uni-

CASE 3 > THE LEUVEN R&D CASE

Resources

A. Organizational resources. Leuven R&D is a department of the "Katholieke Universiteit Leuven" that was founded in 1972 and currently managed as a small-applied research centre with a large independence of the "Katholieke Universiteit Leuven".

B. Human resources. Leuven R&D employs 20 people, of whom 6 people are responsible for the financial succession, 4 people are administrative forces and 10 people provide services to researchers to commercialise the research results. The group of 10 people exists out of 3 engineers, 2 lawyers, 3 people who studied life sciences and who have followed a patent attorney course, and 2 economists. 3 employees have already several years of business experience.

C. Technological resources. Leuven R&D has no specified technological focus, but it tends to focus on IT and Biomedical Ventures, due to the strength of the "Katholieke Universiteit Leuven" in this area.

D. Physical resources. The "Katholieke Universiteit Leuven" and the city of Leuven are the owners of an incubation centre located in Leuven. Leuven R&D conducts the management of the incubation centre, which offers only space to spin-out companies of the "Katholieke Universiteit Leuven".

E. Financial resources. Leuven R&D is self-sustainable and gets his revenues out of research contracts, patents and spin-out companies. The "Katholieke Universiteit Leuven" asks 7% overhead costs for each research contract. 5/7 of these revenues go directly to Leuven R&D. The same principle is used for the revenues generated by patents and spin-out companies.

F. Social resources. Leuven Inc. is a non-profit organization created by 5 companies: Arthur Andersen, Fortis Bank, IMEC, KBC and Leuven R&D. Leuven Inc. is an organization that facilitates networking between different companies and organizes courses to promote high tech entrepreneurship. Due to the close link with Leuven Inc., Leuven R&D has well-developed contacts with the industry.

versity and 80% by a consortium of major banks in the area, which see this investment as a window on opportunity. This fund is usually organized as a VC fund. The invested amount of money ranges from 250 000 Euro to 350 000 Euro per business plan.

F. **Control of the spin out process.** Control happens through the board of directors. This kind of control results in a higher percentage of VC backing. In Leuven R&D, 25% receive venture capital financing in a second round of financing within the first three years. In BioM, 35% of the spin-out companies have already received venture capital financing. These percentages might increase if time evolves.

Resources

A. **Organizational resources.** These spin-out services usually have developed routines and skills in terms of business plan development and market research. From an institutional point of view, they tend to be organised as private non-profit organisations. In contrast to the previous model, they are much less a broker between the public sector and the company and much more a consultant. Heidelberg innovation for instance has its own team of experienced consultants to help start-ups in business plan development.

B. **Human resources.** The human resources of this model are likely to be more experienced in enterprise creation than under the previous model. Leuven R&D, Heidelberg Innovation and BioM have a small team of 3-4 people, which have experience in setting up entrepreneurial technology ventures (either as consultant or entrepreneur). Therefore, they can have an impact on the selection process performed by the fund with which they collaborate.

C. **Technological resources.** Under this model the technological resources are likely to be more focused towards parti-

Activities

A. **Opportunity seeking.** The activities of Leuven R&D are well known among the researchers of the "Katholieke Universiteit Leuven". So, there is no need to perform an active search to look for opportunities to commercialise.

B. **IPR assessment and protection.** Leuven R&D employs a few patent attorneys to perform IPR support.

C. **Selection of the spin-out process.** In some cases, the spin-out service gives support to write a business plan. However, the spin-out service mainly focuses on giving support during the phase of the evolution of a business plan to a business model. Once the business model exists, further advice is offered through settling in the Board of Directors.

D. **Incubation process.** Leuven R&D manages an incubation centre, and offers all support necessary to start-up a spin-out company (business plan advice, patent searches, patent portfolio management, assisting spin-out companies, assisting Leuven Inc.'s activities,…)

E. **Funding.** Potential spin-out companies can receive capital from 3 sources: reserves from the department, Gemma Frisius Fond and external investors. Some departments build up their own reserves, which they use to extend their research group and to give financial support to promising research projects. The Gemma Frisius Fond was created in 1997 as a joint venture between the Katholieke Universiteit Leuven (represent by Leuven R&D) (20%), Investco (currently KBC Investment, 40%) en VIV (currently Fortis Private Equity, 40%) and is a 12,5 mio Euro fund. The Gemma Frisius Fond invests in a spin-out company in the stage of validation of the business plan. The fund invest around 250 000 to 350 000 Euro per project. The external investors only invest in the second round of financing of a spin-out company.

F. **Control of the spin-out process.** A spin-out company is set up in an early stage, but receives substantial support from Leuven R&D. In Leuven R&D, 25% receive venture capital financing in a second round of financing within the first three years.

cular specific technologies. For instance, BioM and Heidelberg Innovation have a focus on biotechnology while Leuven R&D is more focused upon IT (and some biotech).

D. **Physical resources.** As suggested earlier physical resources will be more developed under this model. In Heidelberg Innovation, BioM and Leuven R&D the availability of an incubation centre and a science park is very important to the functioning of the service although space is offered at market prices.

E. **Financial resources.** The combination of private and public capital is crucial for the survival of this model. For instance, BioM is financed by three parties: a consortium of tbg[8] and private VCs, the State of Bavaria, and the local pharma industry. BioM is thus a clear example of public-private partnership. The amount of public capital involved is about 50%. BioM receives money both to invest and to pay its management expenses, which are far above the 3% norm that is normal in the VC industry. Also Leuven R&D is a public/private partnership. The management of its VCFund, Gemma Frisius, and the business plan assistance is paid with public money. The VC fund itself is a joint venture between the Katholieke Universiteit Leuven (represented by Leuven R&D) (20%), KBC Investment (40%) and Fortis Private Equity (40%) and is a 12,5 mio Euro fund. It is exactly on this topic that Heidelberg Innovation was different from BioM and Leuven R&D. In contrast to the previous two, the amount of public money in Heidelberg Innovation collected through the BioRegion scheme was very small (almost negligible). The fund thus acts as a private investor, who is interested to make efficient investments, which are limited in risk. However, the coaching of entrepreneurs in business plan development, the assistance in IP matters, the composition of a real 'team' is a kind of overhead that can not be supported by private investment funds. As a result, Heidelberg Innovation now acts solely as a pure VC fund.

F. **Social resources.** Because start-ups are helped to develop a business plan that is presentable to a VC fund which selects proposals according to the private VC criteria, a well elaborated network and close links with the local industry, specialized advisors and the VC community are important. These links help the spin-out service to attract business developers in the pre-start-up phase, business angels in the advisory committees, patent attorneys…

[8] Technologie Beteiligungsgesellschaft, a specific project within Germany's public bank, which uses public money to take minority investments in high tech start-ups.

[9] InterUniversity Institute for Micro-electronics

[10] The Technology Partnership in Cambridge, UK.

> 3.3 "PROTECTIVE" MODEL

IMEC[9], TTP[10], the Scientific Generics case, the Twinning case and STARLAB were functioning according to a model which we have labelled the **"protective model"**.

Activities

A. **Opportunity Seeking.** Opportunity seeking activities is very pro-active and usually at a very early stage of the research. Usually, these institutes look for all kinds of interesting path breaking research in certain disciplines, which might lead to results that can be commercialised. The creation of a start-up is only one vehicle to commercialise. IMEC is a leading edge applied research institute in the field of microelectronics and looks for projects at a very early research stage in the different universities in Flanders.

B. **Selection of the Spin-out Project.** In terms of project selection an in house fully integrated approach is identifiable under this model covering the technology, the commercial viability, financial requirements and managerial competence. By and large, evaluation is rooted in the technical and commercial expertise of the organization. It is important that spin-out is only one potential vehicle for commercialisation. Only when a research project is considered to be financially attractive (in terms of exponential growth), a company will be created.

C. **IPR Assessment and Protection.** The IPR policy differs quite substantially from the previous two models. Once a project is chosen to have spin-out possibilities, the IPR policy aims at building a technology platform through licensing in other pieces of the technology and cross-licensing some parts.

CASE 4 > THE IMEC CASE

Resources

A. Organizational resources. IMEC is a centre of excellence in the field of microelectronics, and was set up in 1984.

B. Human resources. Within IMEC, 2 departments are busy with the transfer of technology to the industry, namely the Business Development Group and the Realization and Incubation Department. Within the Business Development Group, 5 people are working full time on writing patents and on following up patent procedures. Within the Realization and Incubation Department, 10 people are employed: 6 engineers, 1 lawyer, 2 economists and 1 secretary. 3 of the 6 engineers have already 10 years of business experience. The Realization and Incubation Department is responsible for the technology transfer to the Flemish SME' and for the spin-out companies.

C. Technological resources. IMEC is a centre of excellence in the field of microelectronics. IMEC has a number of associated laboratories: Vrije Universiteit Brussel, Rijksuniversiteit Gent, Limburgs Universitair Centrum and Katholieke Hogeschool Brugge-Oostende.

D. Physical resources. Because the origin of each spin-out company lies within the lab, internal office space is offered for free and infrastructure is available.

E. Financial resources. In 1999, IMEC had a budget of 75 mio EURO: 40 mio EURO came from contract research, the remaining 35 mio were subsidies granted by the Flemish government for fundamental research. The revenues created out of contract research came from the international industry (43%), the Flemish industry (32%), the European Union (20%), the European Space Agency (2,5%) and the government (2,5%). In 2001, IMEC had a budget of 115 mio Euro: 88 mio Euro came from contract research, 27 mio Euro came from the Flemish government.

F. Social resources. The spin-out services are self-contained and self sufficient, because all stages and processes involved in spin-out creation happens within IMEC.

Activities

A. Opportunity seeking. IMEC searches very actively for project at a very early research stage in the different Flemish universities.

B. IPR assessment and protection. IPR support is fully covered by IMEC.

C. Selection of the spin-out process. The selection of a project happens at a very early stage. All potential projects are screened with the target to set up 1 or 2 spin-out companies a year.

D. Incubation process. The spin-off service provides all kinds of support ranging from management and housing of the applied research projects to the provision of offices and meeting rooms for early stage spin-outs, business plan development, recruitment of external management and the composition of their technology platform. The incubation process has thus both a long time horizon and aims at offering a fully in-house support service.

E. Funding. Since January 2002, IMEC owns an incubation fund. This fund was set up by IMEC, Fortis Private Equity, KBC Investco and the Software Holding Finance. The incubation fund is a 5 mio Euro fund, which invest 500 000 Euro per project. Currently, the incubation fund has invested in 2 potential spin-out companies. Once the spin-out company leaves IMEC, IMEC does not invest anymore. The spin-out companies then have to find money with venture capitalists or business angels. The requested amount of money usually varies between 1 to 6 mio Euro. Before the incubation fund was present, IMEC invested non-officially by paying the human resources costs of the people working in the potential spin-out company. Once the company spun out, IMEC asked 15 to 25 % of the shares in return.

F. Control of the spin-out process. A spin-out company is start up in a late stage and with an experienced management team.).

D. Incubation process. The spin-out service provides all kinds of support ranging from management and housing of the applied research projects to the provision of offices and meeting rooms for early stage spin-outs, business plan development, recruitment of external management and the composition of their technology platform.

E. Funding. Both the time scale and nature of the project supported mean that funding requirements are substantially greater than under the other two models. Typically, spin outs from this model start with a capital of 1-4 million euro. To establish these firms, the institutes maintain good contacts with the larger Venture Capital Community. Through their pre-

CASE 5 > THE GENERICS CASE

Resources

A. Organizational resources. Scientific Generics was founded in 1986 by Gordon Edge as a spin-out of PA Technology. The Generics Group, comprises Generics Asset Management Limited (GAMI) responsible for the investment side of the group, Scientific Generics, which undertakes technical and business consultancy, Catella Generics, a Swedish based consultancy in battery and fuel cell technology, GenTech, which is the incubation arm of the group and Genesis Medical Technology a US based company providing medical product development services. The Swedish based Catella acquired a controlling interest in the group in 1996.

B. Human resources. The UK parts of the group (Scientific Generics, GAMI and GenTech) employ approximately 250 people at the Group's base. The majority of employees have a strong scientific or technical background combined with commercial experience. Several senior consultants from Arthur D. Little (formerly Cambridge Consultants) have recently joined Generics. GenTech itself has a dedicated staff of 5, but all potential spin-out projects are assessed by the Group's Innovation Exploitation Board (IEB) which draws upon a wide range of Generics professionals, depending on the nature of the proposal.

C. Technological resources. As a technical consultant Generics has specialist expertise in communication technology involving both data and voice and fixed and wireless technology including Bluetooth technology, in engineering with sensing and metering applications, particularly in respect of medical products and in life sciences and bio informatics.

D. Physical resources. Generics' has extensive physical resources on-site at its location at Harlston Mill just outside of Cambridge. It has a wide range of laboratory facilities including a CommsLab for communication technology work. It has recently obtained permission to double the size of its facilities at Harlston, increasing both laboratory and office space available to potential spin-out companies.

E. Financial resources. Consultancy fees and income from IP (licences, and equity in spin-outs) indirectly provide resources. Consultancy fee income last year was 27 million euro and Generics Group holds IP valued at 40 million euro. The IEB will consider potential spin-out projects generated outside of the Generics Group, but they will bring in-house and treated and supported in the same way as projected generated by Generics employees.

F. Social resources. Generics is one of a small number of technical consultancy firms, which have become a notable feature of the Cambridge high tech environment. Generics, and especially its founder Gordon Edge have a very high profile in the local Cambridge business environment. Generics funds the first prize for the Cambridge University Entrepreneurs competition, it is at the forefront of the Cambridge 3G Mission (a communication technology application test network) for which it is the project manager. It is an active member of the Cambridge Network and of the GEIF (Great Eastern Investment Forum) a group of business angels. Facilities in Sweden and the USA further extend the resources to which it has access.

ferred partnerships and informal networks with this community, they attract financing for their spin-outs at founding. In addition, most of them have their own VC fund, which co-invests in the spin-outs and often considers investing in spin-ins as well. No public money is involved.

F. **Control of the spin out process.** We have labelled this model 'protective' because it provided extensive in house support from idea generation right the way through to final separation. The stage at which, and process by which separation occurs may vary: TTP is like a Portuguese-Man-of-War, a colony of related but independent organisms, separation is referred to as 'demerging' and at this stage the 'spin out' may be very

Activities

A. **Opportunity seeking.** In setting up Generics Gordon Edge aimed to establish a creative environment dedicated to the exploitation of technology. The organization has a flat structure and this is reflected in the physical configuration of the space: open plan offices and glass walled labs to remove barriers to communications. Employees are encouraged to be inventive. At the core of the incubation model is the IEB, which meets monthly to review innovative ideas presented by consultants, Generics employees and external sources. The IEB may also approach people with a view to encouraging them to come up with innovative suggestions. The company has a Reward to Inventors Scheme, which encourages employees to be innovative.

B. **IPR assessment and protection.** Generics initially owns all the IPR in respect of its developments, occasionally, depending on the nature of the external contract, this might be shared with another organisation or client. Generics seeks to establish platforms of IPR on which it can base future development and has a proactive approach to this in respect of its consultancy work. Last year it made 268 patent applications. When a company is spun out Generics would initially retain 100% of the equity. Depending on subsequent funding those employees who championed the venture and left Generics to join the new company might subsequently be left with up to 20% of the equity.

C. **Selection of the spin-out process.** Selection of projects is made by the IEB at its monthly meetings.

D. **Incubation process.** Once a project has been deemed interesting by IEB, resources and funding are allocated to the project. GenTech will write the business plan, handle the IP issues, evaluate markets and organize the development of the technology and, where appropriate, the building of prototypes. Essentially the concept is 'matured' within the protective walls, (both physical and legal) of Generics. When it becomes apparent that the value of the new business is sufficiently established Generics will create a spin-out company, initially retaining 100% of the equity. Generics employees championing the venture will normally leave Generics at this stage to staff the new company and will be awarded some percentage of the equity, but depending on the nature of the spin-out external professionals may also be bought in.

E. **Funding.** Generics has an internal fund of 3-4 million euro to provide seed and early stage support. Indirect support in also provided through the use of the Generics facilities. Because of its extensive contacts with sources of angel and venture capital obtaining additional and development funds for spin-out companies is not problematic.

F. **Control of the spin-out process.** Potential spin-out companies remain within the protective environment of Generics until such time as their commercial and technical viability can be demonstrated. Compared to many other schemes therefore separation is relatively late with the venture having a relatively developed product/service, actual or clearly identified potential customers/ clients and a developed management team. However Generics has a clear objective of making a return on spin-outs through trade sales or IPO. To date, Generics has spun out 7 companies.

large, employing 100+ and may go straight to IPO. Separation in Starlab, Twinning, Generics and IMEC is earlier, often with a trade sale in Generics and Starlab and always through VC involvement in IMEC. In all cases, the spin out will have a well-development professional management team, which will probably involve outsiders.

Resources

A. Organizational resources. The organizations of this model are centres of excellence and independent institutes with a steady revenue stream. Twinning had the same activities as the other examples, but was not a centre of excellence in research. Instead it had to tap upon the university resources and did not have the in-house scientific expertise. Neither could it build a portfolio of contract research and

CASE 6 > THE TTP CASE

Resources

A. Organizational resources. The Technology Partnership was founded in 1987 by 25 people, largely as a spin-out of PA Technology. Although a plc TTP is three quarters owned by its staff. It has three wholly owned subsidiary companies: Acumen Bioscience Ltd, TTP Ventures Limited, a venture capital fund and The Creativity Partnership involved in consultancy and training.

B. Human resources. TTP employs approximately 400 people, the majority are scientifically or technically qualified but there is a strong emphasis on commercial experience.

C. Technological resources. TTP's undertakes software design, development and manufacture of advanced diagnostic instruments, product development and development of automated manufacturing systems. It has specialist expertise in the following areas: software, micro-electro-mechanical systems, micro-fluids, optics and opto electronics and lasers, modelling and sensors, and the development of integrated biology/ hardware solutions. The applications of its development work range from electronic aerosol technology for inhalation drugs, through digital printing, to sensors for the residual contents of envelopes and drug discovery platforms.

D. Physical resources. TTP has extensive physical resources on-site at its location on the Melbourne Science Park to the south of Cambridge. It occupies the majority of the 17-acre science park and has a wide range of laboratory facilities including class 2 containment facilities for work in genomic and cell biology. Potential spin-out companies are full and easily accommodated on-site.

E. Financial resources. There is not dedicated fund for potential spin-outs in TTP but spin-out companies are rather funded from income. Development work in TTP is split with 50% being undertaken on a contract basis for external clients and 50% as in-house development work. Hence income is generated from development and consultancy work done under contract, from licenses from earlier development work and from revenue from manufacture of instruments and systems.

F. Social resources. As an organization TTP is recognized as one of a small number of technical consultancy firms, which have become a notable feature of the Cambridge high tech environment. Also at the organizational level its activities contribute to the exchange of personnel at all levels not just those with scientific or technical backgrounds but those from legal and commercial backgrounds. Technically, commercially and financially TTP Group plc has strong and extensive links within the Cambridge area and beyond. At an individual level, many of the founders and senior members of the company are notable figures in the Cambridge Network.

Activities

A. Opportunity seeking. TTP is a rather unique organization, with an extremely flat structure, operating on strongly egalitarian principles. It has sought to develop a culture of 'structured autonomy' under which

spin-outs. This was one of the reasons why the Twinning could not find attractive projects.

B. **Human resources.** A professional staff from a wide variety of backgrounds and disciplines and is able to draw upon 'in house' specialists in particular technologies. It is very important to stress that the successful models of this kind are centres of excellence built around a small number of leading edge researchers, preferably with sufficient business experience and charisma. Such individuals are not easily found on the labour market and it takes time to train them.

C. **Technological resources.** The centres of excellence are relatively narrowly focused on particular specialisms, in which they have a wealth of experience. The distinction between fundamental and applied research is not important, but breadth is. For example, Scientific Generics claims

researchers are given considerable freedom and resources to explore potential projects. There are no formal structures or mechanisms defining the amount of time and resources individuals or groups can spend on potential developments, rather such limits come to be 'understood'. The culture encourages people to experiment and to 'spot' opportunities suitable for development and exploitation through licensing, collaboration or spin-outs arising within both from in-house and contract based development work.

B. **IPR assessment and protection.** TTP Group owns all the IPR in respect of its developments, occasionally, depending on the nature of the external contract, this might be shared with another organisation or client. It is highly active in patenting filing some 25 per annum.

C. **Selection of the spin-out process.** Selection of a project is based on three criteria: technical novelty, commercial viability and the opportunity to obtain a competitive advantage (whether TTP has the capacity to do as good or better job than anyone else.) From this point on the project is treated as a formal proposal, with clearly set objectives and subject to monitoring on exactly the same basis as a project undertaken for an external client.

D. **Incubation process.** All aspects of the incubation process and commercial planning are fully supported in-house since once selected the potential spin-out project is undertaken on the same basis as an external project.

E. **Funding.** For two reasons TTP seldom seek venture capital or any form of public sector support for the development of potential spin-out projects. First they are undertaken as part and parcel of TTP's overall activities and as such funded from current income, and second the very late stage at which separation of spin-out companies occurs in TTP. In 1998 TTP Group plc set up TTP Ventures limited as a wholly owned subsidiary. The principal investors in this venture fund, which has a total commitment of 58 million, are NPM Capital (the largest and oldest independent venture group in the Netherlands), The Boeing Company, Siemens Venture Capital and Abbey National. TTP Ventures invests in external (to TTP) early stage companies in the UK and Europe, specializing in companies in technologies, which map closely onto those of TTP. Investments range from seed 83,000 to a maximum of 5 million from TTP Ventures alone (additional sums being available from syndication partners.)

F. **Control of the spin-out process.** TTP's approach is that setting up a new technology business is an extremely difficult and risky process. Consequently potential spin-out companies remains within the protective environment of TTP as profit centres for a very long time. They will either move to become totally owned subsidiaries or 'demerged'. At the stage of demerging the 'spin-out' will have a well developed management structure, usually built around the TTP researchers who championed the project, but may include outsiders, a proven track record and is likely to be a substantial venture e.g. employing more than 100. TTP's last demerger of TTP Communications Ltd. went almost directly to IPO.

not to be involved in fundamental research, but is more involved in 'development". But Scientific Generics is a recognized specialist in its particular narrow field. IMEC claims to be the leading institute in microelectronics.

D. **Physical resources.** Because the origin of each spin off company lies within the lab, internal office space is offered for free and infrastructure is available. This model keeps its spin outs within the protective environment of the "parent". TTP has extensive physical resources on-site at its location on the Melbourne Science Park to the south of Cambridge.

E. **Financial resources.** The financial resources needed to set up this kind of model are substantial. First, a large investment is needed to create a centre of excellence; In the IMEC case this was only possible because the Flemish government has invested each year about 30 million euro in the institute since its inception in 1984. The first spin-outs date from the early nineties and the successful ones were only generated in the second half of the nineties. By then, IMEC had its reputation and a steady stream of contract research revenues. Generics has a different history, since no public money was involved. However, the personal wealth and network of its founder, Gordon Edge, who was also involved in the founding of PA Consulting and Cambridge Consultants (later sold to Arthur D Little), provided a similar knowledge reputation and sound financial base. Examples of this kind, which started up without a sound financial base are bankrupt today (e.g. Starlab in Belgium

F. **Social resources.** Because the spin-out services effectively manages and supports all of the stages and processes involved in research-based spin out creation, the potential for the entrepreneurial context to add to the support is quite low. The spin-out services are self-contained and self-sufficient. Generics is one of a small number of technical consultancy firms, which have become a notable feature of the Cambridge high tech environment. Generics, and especially its founder Gordon Edge have a very high profile in the local Cambridge business environment.

Chapter 4

CONCLUSIONS

This paper posed the research question: "how are spin-out services organised and can we detect different patterns in their activities and resources?" In addressing this question, we have identified three distinct spin-out models, which follow a different trajectory: the low selectivity model, the supportive model and the protective model. This paper concludes by discussing the implications for researchers, practitioners and policy and the suggestions for further research.

The low selectivity model aims at creating as many spin-outs as possible. The basis for spin-out activity cannot only be a distinctive technology. The company can as well be based upon a skill developed at the university. The result is that many companies are created but only few have a growth ambition and even fewer realize growth. Nevertheless, these companies might be of crucial importance in terms of regional development and the formation of high tech clusters. In the low selectivity model, public money is crucial. Instead of providing the spin-outs equity financing, small grants are given to entrepreneurs and cheap office space is provided. Private money is not useful for this purpose.

The supportive model aims at creating companies with a growth ambition (although this growth ambition might not be proven at the moment of start-up). Therefore, the basis for start-up is usually some piece of technology that can be protected and provide a unique advantage. Pure knowledge based consulting firms are usually not supported in this model. Usually, business plans form the basis for selection. However, because the growth might be unclear at start and – related – the amount of start-up capital remains rather low, private VCs tend not to be interested in these start-ups. On the other hand, these VCs usually have a better knowledge to evaluate the business potential of a start-up. Therefore, we observe that these spin-out models tend to form public-private partnerships. The public money is used to finance the management of the fund and the coaching for the entrepreneurs, while the private part serves to finance the investment. To run such a spin-out service, different skills are needed from the previous one. In addition, the number of spin-outs tends to be limited in comparison to the previous model.

The protective model sees spin-outs as one trajectory of commercialising research results. A spin-out will only be formed if a patent portfolio can be constructed which is broad and strong enough. This means that at start it must already be clear that the company can establish a growth trajectory. External VCs are attracted from the very beginning. A crucial competence of these spin-out services is an in depth knowledge of certain technology domains. These institutes all tend to be specialised in a very specific technology. Those that were not such as Twinning and Starlab either had to change their mission or simply went bankrupt. A second key resource is money. It takes a very long time and an enormous amount of money to create a scientific centre of excellence. The Starlab case clearly illustrates that 60 million Euro is far from sufficient. The IMEC case shows that it can take up to twenty years and a tenfold of the Starlab investment to build such a centre.

In further research, we will analyse whether and how the institutional context forces spin-out services to organise their activities using the resources they have. Resource dependency theory will be a point of departure to analyse the deviation from the three models that seem to work.

TABLE 1 > ***Systematic overview of the activities and resources generated by the three models***

	LOW SELECTIVITY MODEL Based upon Crealys and Twente	**SUPPORTIVE MODEL** Based upon Leuven R&D and BioM	**PROTECTIVE MODEL** Based upon IMEC, TTP, Scientific Generics
ACTIVITIES			
Technology opportunity search	Rather passive, relies on entrepreneurial university	Passive; might organize a business plan competition; attracting business plans rather than ideas; relies on the reputation of the fund	Active opportunity seeking worldwide
Intellectual property assessment and protection	Emphasis on commercialising technology through patents	Support in patent and license negotiation with the industry	TTO will acquire an IPR platform (not limited to one patent) at an early stage
Selection of the spin-out project	Selection criteria are extremely low. Maximize the spin-outs	Among the selection criteria, growth orientation is important. But, remain lower than in private VCs	Selection criteria resemble those of the VCs
Incubation and business plan development	Projects are offered space at the research centre or university	Incubation centre and Science park; Specialized support available out house at market prices	'In house' incubation and support at all stages of the spin out process and to a high level
Funding process	small amounts, ranging from 15 000 Euro to 100 000 Euro, under the form of public grants	Public private equity fund, ranging from 250 000 Euro to 350 000 Euro	VC money, ranging from 1 mio Euro to 4 mio Euro
Support with start-up process	Project is started at a pre-founding stage. All types of start-up are selected	Spin off company is start up at a very early stage, focus upon transitional starters	Spin off company is start up in a late stage and with an experienced management team
RESOURCES			
Organizational resources	Public organizations, linked with universities	Private organizations linked with universities	Centre of excellence, close link with industry
Human resources	Small team, familiar with public sector	Larger (5-7 persons) multi-disciplinary team, with links to the financial world to be able to evaluate the business plans	Experienced professional staff. Able to draw upon 'in house' specialists
Technological resources	No technological focus or specialisms	Focus on the best performing departments of the universities Mainly applied research	Relatively narrowly focused on particular specialisms in which it has a wealth of experience
Physical resources	Offer office space and infrastructure within the universities	Offer office space and infrastructure within an incubation centre, at market prices	Internal research space and infrastructure is offered for free
Financial resources	Need a large amount of public money to offer at the spin-outs	Need to set up an associated fund with public/private partners	Invested money is private money, the TTO may have its own VC fund
Social resources	Entrepreneurial climate within university or research centre is very important	Entrepreneurial context is very important	Entrepreneurial context is scarcely important

REFERENCES

- **ABERNATHY**, W.J. & **UTTERBACK**, J.M. (1978) ''Patterns of Industrial Innovation.'' Technology Review, June/July, 41-47.
- **AUTIO**, E. & **YLI-RENKO**, H. (1998) ''New, technology-based firms in small open economies – An analysis based on the Finnish experience.'' Research Policy, 26, 973 – 987.
- **BANNOCK**, G. (1998) ''EU Innovation Finance Benchmarks.'' Brussels: BE, European Commission, DG XIIID-4: SPRINT/EIMI.
- **BARNEY**, J., **WRIGHT**, M. & **KETCHEN**, D. (2001) ''The Resource Based View: Ten Years after 1991.'' Journal of Management, 27(6).
- **BRANSCOMB**, L.M. & **AUERSWALD**, P.E. (2001) ''Taking Technical Risks. How innovators, Executives, and Investors Manage High-Tech Risks.'' The MIT Press, Cambridge Massachusetts.
- **BROWN**, S.L. & **EISENHARDT**, K.M. (1995) ''Product Development: Past Research, Present Findings and Future Directions.'' Academy of Management Review, 20 (2), 343 – 378.
- **BRUSH**, C.G., **GREENE**, P.G. & **HART**, M.M. (2001) ''From initial idea to unique advantage: The entrepreneurial challenge of constructing a resource base.'' Academy of Management Executive, 15 (1), 64 – 78.
- **CLARYSSE**, B., **HEIRMAN**, A. & **DEGROOF**, J. (2000) ''An institutional and resource based explanation of growth patterns of research based spin-offs in Europe.'' Frontiers of Entrepreneurship Research 2000, 545-559.
- **CLARYSSE**, B., **HEIRMAN**, A. & **DEGROOF**, J. (2001) ''Analysis of the typical growth path of technology-based companies in life sciences and information technology, and the role of different sources of innovation financing.'' An EIMS study as part of the innovation programme commissioned by the European Commission.
- **CLARYSSE**, B., **HEIRMAN**, A. & **MORAY**, N. (forthcoming) ''Transferring technology by spinning off ventures: Towards an empirically based understanding of the spin off process.''
- **CLARYSSE**, B. & **MORAY**, N. (2001) ''A process study of entrepreneurial team formation: the case of a research-based spin-off.'' Journal of Business Venturing, special issue on technological entrepreneurship.
- **CHIESA**, V. & **PICCALUGA**, A. (2000) ''Exploitation and diffusion of public research: the general framework and the case of academic spin-off companies.'' R&D Management, 30, 329 – 340.
- **COM CEC 552** (1998). Risk Capital: A Key to Job Creation in the European Union. April, 1998, 28.
- **COVIELLO**, N. & **MCAULEY**, A. (1999) ''Internationalisation and the Smaller Firm: A Review of Contemporary Empirical Research.'' Management International Review 39(3), 223-256.
- **DEBACKERE**, K. (2000) ''Managing academic R&D as a business at K.U.Leuven: context, structure and process.'' R&D Management, 30, 323 – 328.
- **DEGROOF**, J. (forthcoming). Doctorial Dissertation.
- **EISENHARDT**, K. (1989) ''Building Theories from Case Study Research.'' Academy of Management Review, 14(4), 532 - 550.
- **EISENHARDT**, K.M., **SCHOONHOVEN**, C.B., K.M. & **LYMAN**, K. (1990) ''Speeding Products to Market: Waiting Time to First Product Introduction in New Firms'' Administrative Science Quarterly, 35, 177 – 207.
- **HELLMANN**, T. & M. **PURI**. (2000) ''The Interaction Between Product Market and Financing Strategy: The Role of Venture Capital'' The Review of Financial Studies, 13 (4), 959 – 984.
- **HENDERSON**, A.D. (1999) ''Firm Strategy and Age Dependence: A contingent View of the Liabilities of Newness, Adolescence, and Obsolescence.'' Administrative Science Quarterly, 44, 281 – 314.
- **KARNEBECK**, A. (2001) "Spin-offs and the University of Twente", University of Twente Press.
- **KAZANIJAN**, R.K. (1988) ''Relation of dominant problems to stages of growth in technology-based new ventures.'' Academy of Management Journal 31 (2), 257-279.
- **LERNER**, J. & **GOMPERS**, P. (1999) ''The Venture Capital Cycle.'' Cambridge, MA, MIT Press.
- **MUSTAR**, P. (1995) ''The Creation of Enterprises by Researchers: Conditions for Growth and the Role of public Authorities. High-level Workshop on SME's: Employment, Innovation and growth.'' OECD, Washington, 16-17 June.
- **MUSTAR**, P. (1997) ''Spin-off enterprises. How French academics create hi-tech companies: the conditions for success and failure.'' Science and Public Policy, 24, 37 – 43.
- **QUINCE**, T.A. and **WHITTAKER**, D.H (2002) 'High Technology Businesses and Niche Markets' forthcoming Working Paper, ESRC Centre for Business Research, University of Cambridge.
- **ROBERTS**, E.B. (1991) ''Entrepreneurs in high technology: Lessons from MIT and beyond.'' Oxford University Press, Chapter 3, 46 – 99.
- **ROBERTS**, E.B. & D.E. **MALONE** (1996) ''Policies and Structures for spinning off new companies from research and development organizations.'' R&D Management, 26(1), 17 – 48.
- **SAHLMAN**, W.A. (1990) ''Why Sane People Shouldn't Serve on Public Boards.'' Harvard Business Review 68(3), 28-33.
- **SAXENIAN**, A. (1994) ''Regional advantage. Culture and competition in Silicon Valley and Route 128.'' Harvard University Press.
- **SEGAL QUINCE & PARTNERS** (1985) 'The Cambridge Phenomenon: The Growth of High Technology Industry in a University Town.' Cambridge, SQW Ltd.
- **SEGAL QUINCE WICKSTEED** (2000) ''The Cambridge Phenomenon Revisited Part One.'' Cambridge SQW Ltd.
- **STANWORTH**, M.J.K. and **CURRAN**, J. (1976) Growth and the Small Firm: An Alternative View', Journal of Management Studies, 13 (2) 95-110
- **STOREY**, D.J. (1994) ''Understanding the small business sector.'' London, International Thompson Business Press.
- **SUCHMAN**, M.C. (1994) ''On advice of counsel: Law Firms and Venture Capital Funds as Information Intermediaries in the Structuration of Silicon Valley.'' Stanford university, department of Sociology.
- **SUCHMAN**, M.C. (1995) ''Managing legitimacy: Strategic and institutional approaches.'' The Academy of Management Review 20 (3), 571-611.

- ***TEECE**, D.J. (1986) ''Profiting from Technological Innovation: Implications for Integration, Collaboration, Licensing and Public Policy." Research Policy 15 (6), 285-306.*
- ***TETHER**, B.S. & **STOREY** D.J. (1998). ''New technology-based firms in the European Union: an introduction." Research Policy 26, 933-946.*
- ***TIMMONS**, J. & **SAPIENZA** H. (1992) ''Venture capital: the decade ahead. The State of the Art of entrepreneurship." D.L. Sexton and J.D. Kasarda. Boston, MA, PSW-Kent: 402-437.*
- ***WTTERWULGHE**, R. (1998). "La P.M.E. Une entreprise humaine." Brussels, De Boeck Université.*

VTO-STUDIES:

1/ Het Vlaams Innovatiesysteem: een nieuw statistisch beleidskader

1annex/ Theoretische en empirische bouwstenen van het 'Vlaams Innovatie Systeem'

2/ Innovatiestrategieën bij Vlaamse industriële ondernemingen

3/ Octrooien in Vlaanderen: technologie bekeken vanuit een strategisch perspectief

Deel 1: Octrooien als indicator van het technologiesysteem

4/ De impact van technologische innovaties op jobcreatie en jobdestructie in Vlaanderen

5/ Strategische verschillen tussen innovatieve KMO's : Een kijkje in de zwarte doos

6/ Octrooien in Vlaanderen: technologie bekeken vanuit een strategisch perspectief

Deel 2: Analyse van het technologielandschap in Vlaanderen

7/ Diffusie van belichaamde technologie in Vlaanderen: een empirisch onderzoek op basis van input/outputgegevens

7 annex/ Methodologische achtergronden bij het empirisch onderzoek naar de Vlaamse technologiediffusie

8/ Schept het innovatiebeleid werkgelegenheid?

9/ Samenwerking in O&O tussen actoren van het "VINS"

10/ Octrooien in Vlaanderen: technologie bekeken vanuit een strategisch perspectief

Deel 3: De internationale technologiepositie van Vlaanderen aan de hand van octrooi posities

Deel 4: Sporadische en frequent octrooierende ondernemingen : profielen

11/ Technologiediffusie in Vlaanderen. Enquêteresultaten - Product- en diensteninnovatie: evolutie 1992-1994-1997

12/ Technologiediffusie in Vlaanderen. Enquêteresultaten - Hoogtechnologische producten: evolutie 1992-1994-1997

13/ Technologiediffusie in Vlaanderen. Enquêteresultaten - Procesautomatisering: evolutie 1992-1994-1997

14/ Technologiediffusie in Vlaanderen. Methodologie en vragenlijst

15/ Financiering van innovatie in Vlaanderen. Het aanbod van risicokapitaal.

16/ Product- en diensteninnovativiteit van Vlaamse ondernemingen. Enquêteresultaten 1997

17/ Adoptie van procesautomatisering en informatie- en communicatietechnologie in Vlaanderen. Enquêteresultaten 1997

18/ Performantieprofiel en typologie van innoverende bedrijven in Vlaanderen. Waarin verschillen innoverende bedrijven van niet-innoverende bedrijven. Enquêteresultaten 1997

19/ De werkgelegenheidsimpact van innovatie: is de aard van de innovatie-strategie belangrijk?

20/ Samenwerking in O&O tussen actoren van het "VINS"

Deel 2: Samenwerking in een aantal specifieke technologische disciplines

IWT-STUDIES:

21/ Clusterbeleid: Een innovatie instrument voor Vlaanderen? Reflecties op basis van een analyse van de automobielsector

22/ Benchmarken en meten van innovatie in KMO's

23/ Samenwerkingsverbanden in O&O en kennisdiffusie

24/ Financiering van innovatie in Vlaanderen. De venture capital sector in internationaal perspectief

25/ De O&O-inspanningen van de bedrijven in Vlaanderen - De regionale uitsplitsing van de O&O-uitgaven en O&O-tewerkstelling in België 1971-1989

26/ De O&O-inspanningen van de bedrijven in Vlaanderen - Een perspectief vanuit de enquête voor 1996-1997

27/ Identificatie van techno-economische clusters in Vlaanderen op basis van input-output-gegevens voor 1995

28/ The Flemish innovation system: an external viewpoint

29/ Geïntegreerd innovatiebeleid naar KMO's toe. Casestudie: Nederland

30/ Clusterbeleid als hefboom tot innovatie

31/ Resultaten van de O&O-enquête bij de Vlaamse bedrijven

32/ 'Match-mismatch' in de O&O-bestedingen van Vlaamse en Belgische bedrijven in termen van de evolutie van sectoriële aandelen

33/ 'Additionaliteit'- versus 'substitutie'-effecten van overheidssteun aan O&O in bedrijven in Vlaanderen: een econometrische analyse aangevuld met de resultaten van een kwalitatieve bevraging

34/ Het innovatiebeleid in Ierland als geïntegreerd element van het ontwikkelingsbeleid: van buitenlandse investeringen naar 'home spun growth'

35/ ICT Clusters in Flanders: Co-operation in Innovation in the New Network Economy

36/ Het fenomeen spin-off in België

37/ KMO-innovatiebeleid levert toegevoegde waarde aan Vlaamse bedrijven

38/ Technology watch in Europa: een vergelijkende analyse

39/ ICT-Monitor Vlaanderen: Eindrapport van een haalbaarheidsstudie

40/ Innovation Policy and Sustainable Development: Can Innovation Incentives make a Difference?

Biography

BART CLARYSSE

Bart Clarysse is an associate professor in 'innovation & entrepreneurship' at the University of Ghent and the Vlerick Leuven Gent Management School. He has published several international articles in the field of technology transfer, innovation management and high tech entrepreneurship.

ANDY LOCKETT

Dr. Andy Lockett is a lecturer in strategy at Nottingham University Business School since 1998. His primary research interests straddle the areas of technology, strategy and entrepreneurship. He has published in a wide range of different journals. In addition, he is currently co-managing an ESRC ROPA funded project (with Prof. Mike Wright) into University Technology Transfer. Also, he is co-ordinating the UK component of the INDOCOM project.

THELMA QUINCE BA. PHD

Thelma Quince is Research Fellow at the ESRC Centre for Business Research at the University of Cambridge. She is also Research Associate at the Centre for Family Research of the University of Cambridge where she is primarily involved in the potential psychological impact of procedures and protocols in antenatal care. She is involved in work on high technology small firms, including a comparative study of the entrepreneurs of such firms in the UK and Japan. Thelma is working in a European study of schemes aimed at creating high technology spin out firms from research organisations.

ELS VAN DE VELDE

Els Van De Velde graduated as a civil engineer in 2001 at the Ghent University. After graduation she started as a research assistant at the Ghent University working on a project of Technology Transfer. As from January 2003 on she starts on a PhD concerning corporate venturing processes.

WHAT IS THE IWT?

The Institute for the promotion of innovation through science and technology in Flanders (IWT-Vlaanderen) is an agency of the Flemish government, established in 1991, with a mission to support industrial R&D and stimulate technological innovation.

With an annual budget of more than 200 million euro IWT supports the Flemish Innovation System on different levels: from subsidies to individual or cooperative R&D projects, a special programme to support innovative SMEs, activities to promote international technology transfer and participation in the European Framework Programme, to schemes for the support of collective innovation (collective research, innovative clusters).
This wide range of activities has made IWT the knowledge centre for R&D and innovation in Flanders.

WHAT IS THE IWT-OBSERVATORY?

The IWT-Observatory (Innovatie - Wetenschap - Technologie Observatorium) is a policy support unit of IWT-Vlaanderen. IWT-Observatory has a mission to support the knowledge management of IWT and the evaluation of innovation performance. For this purpose it collects indicators on R&D and innovation activities in Flanders and organises innovation studies.